ISSN 1018-5593

JRC Scientific and Technical Reports

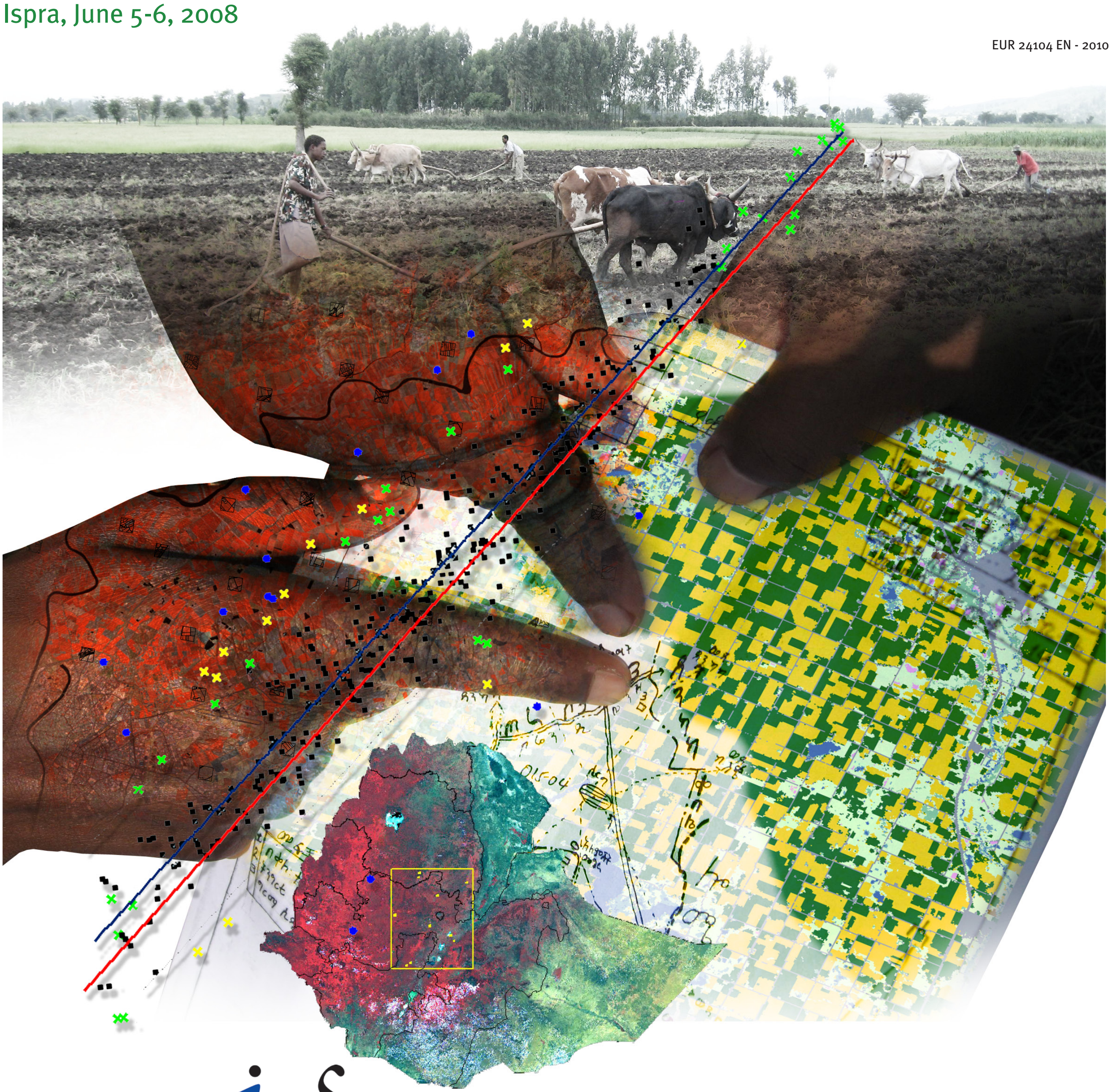
GEOSS Community of Practice Ag 0703a

Best practices for crop area estimation with Remote Sensing

Edited by Gallego J., Craig M., Michaelsen J., Bossyns B., Fritz S.

Ispra, June 5-6, 2008

EUR 24104 EN - 2010



JRC EUROPEAN COMMISSION

ipsc Institute for the Protection and Security of the Citizen

GEO GROUP ON EARTH OBSERVATIONS

The mission of the JRC-IPSC is to provide research results and to support EU policy-makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.

European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Address: Via Fermi 2749, TP 483
E-mail: javier.gallego@jrc.ec.europa.eu
Tel.: +39 0332 785101
Fax: +39 0332 783033

http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

PUBSY: JRC 54658
EUR 24104 EN
ISBN 978-92-79-16211-4
ISSN 1018-5593
doi: 10.2788/31835

Luxembourg: Publications Office of the European Union

Printed in Italy

Group on Earth Observations

June 2008

Best practices for crop area estimation with Remote Sensing.

Purpose of this document: This document gives recommendations on different ways to use Earth Observation as a tool for crop area estimation highlighting strengths and limitations. The document was discussed in a workshop hosted by the Joint Research Centre (JRC) of the European Commission in June 2008 and attended by 40 remote sensing practitioners and users (see list in annex).

Rationale and targets

The management of agricultural policy and food security require timely and possibly objective agricultural statistics. In well organized countries crop area estimates are generally available a few months after harvest; having reliable figures before harvest is a major challenge.

Satellite images with a high and moderate spatial resolution are expected to have a strong development in the next years: Rapid Eye, Sentinel, LDCM (Landsat Data Continuity Mission) and others will be added to the currently available sensors. An increase can be expected in the number of applications of the new sensors to agricultural monitoring and in particular to crop area estimation.

Issues addressed in this document

This document intends to give guidelines on the feasibility of different approaches and general rules on the accuracy assessment that should be respected when reporting results. The document focus is on methods that can be considered operational or pre-operational. Crop area estimation is addressed, but most criteria can be applied to land cover area estimation for environmental purposes. Crop mapping is only considered as an intermediate tool for area estimation (stratification or masking). Qualitative auditing of available crop area statistics (for example the USDA-FAS approach) is also out of the scope of this document.

It is obvious that the better the image processing and classification the more efficient their use for area estimation, but this document does not particularly look at the specific aspects of image processing (radiometric-geometric correction, classification algorithms, etc). What we try to analyze more in depth is the step from classified images to area estimation. The importance of confusion matrices and the combination of Earth Observation data with ground observations is highlighted both for the area estimation and the accuracy and objectivity assessment.

There is a high number of interesting research topics and experiments that should help to improve the results and to enlarge the field of operational use in the future. An analysis of such topics is in principle out of the scope of this document. Research topics are only mentioned in a generic way to mean that they are not operational with the current status of the art.

Refer to this document as:
GEOSS (2009). Best practices for crop area estimation with Remote Sensing. Edited by Gallego J., Craig M., Michaelsen J., Bossyns B., Fritz S. Ispra, June 5-6, 2008

Needs for crop area and production estimation/forecasting.

Crop area and yield estimation are the two components of crop production estimation. For most purposes (in particular market management and food security) the real need is information on production, although only the area estimation issue is analysed in these guidelines. The priority can be on area estimation if area has a strong inter-annual variability while yield remains relatively stable. On the contrary the priority will be on yield for countries were crop area change is rather smooth or predictable and yield change can be stronger. The increasing impact of the biofuel policy ant the turbulences in the agricultural commodities market have introduced an additional source of instability on the managing decisions of farmers and therefore an enhanced interest on early crop area estimation.

Decision makers have a certain level of knowledge of the situation of agriculture in the area they deal with, but some uncertainty is always left. Additional information sources, in particular remote sensing, aim at reducing the uncertainty. The value added can be measured by the fulfilment of at least one of the next conditions:

1. The inaccuracy of estimations is smaller than the uncertainty of the information previously available.
2. The geographical detail of the estimates provided is finer than the existing information. This target corresponds to crop mapping rather than crop area estimation. As stated before, we will not analyse in depth this type of information in this document.

Market monitoring and food needs assessment.

When the main target is monitoring world markets, the priority is concentrated on the most important producing regions. Less intensive cultivation, in particular subsistence agriculture, has a limited importance for this purpose. This is often the situation for developed countries or for the private sector (large trading companies). The needs of DG Agriculture of the EU would fall also in this case.

If the main target is the assessment of food needs in famine or crisis situations, the situation changes; a major interest is concentrated on subsistence agriculture and small farms. This happens in general for developing countries or international organisations dealing with food aid: FAO, WFP, US-AID, DG AIDCO of the EU, etc.

Accuracy needs

The aim of new methods is getting estimates that are more accurate and more objective than available data or than alternative procedures than can be carried out with a similar cost. Let us consider early estimation providing figures when traditional statistical data are not yet available; the target is having an error smaller than the uncertainty of available information. Such uncertainty mainly depends on the degree of historical stability of crop area; it also depends on how predictable is the reaction to policy measures or to market changes. For example the average rate of interannual changes of the total area of cereals per country in the larger cereal producers in the EU (France, Poland, Spain, Germany, Italy, UK) is between 2% and 3%. Changes are often driven by known policy measures, such as compulsory set aside; therefore the level of uncertainty at the beginning of the agricultural season is generally less than 2% and early estimates should have a better accuracy to be useful. Uncertainty is larger in some countries of central Europe (Romania, Hungary, Bulgaria), where the average interannual change ranges between 7% and 9% and consequently there is a stronger need of early estimates, that have a wider room to be useful for decision makers.

Geographic detail

Mapping major events is useful, for example to take timely decisions on declaration of natural disaster for specific aids or for managing agricultural insurances. The mapping approach allows to consider areas that do not coincide with administrative units (regional boundaries). For this type of information timeliness can be more important than a statistical analysis of errors; photo-interpretation of images can give precious information.

Timeliness

The first consideration to be made on timeliness is quite obvious: the earlier the better. If we try to be more precise, we can consider that decision makers often have key dates in which the information is required; for example the US Agricultural Statistics Board meets mid-October to decide on the official figures for the agricultural year and consolidated data are required around the 10th of October. For the private sector, there is no fixed date: the target is having reliable information before the competitors.
We classify approaches from the timing point of view into 3 classes:

- Normal timing: 2-3 months after harvest.
- Early estimation: 1-2 months before harvest
- Forecasting: 4-5 months before harvest.

The timing or schedule of crop area estimation or early estimation depends on the following elements:

- Number of days after sowing a crop takes to be detected by a remote sensor
- Spatial variability in sowing practices of the region
- Crop calendars of competing crops
- Characteristics of remote sensors (revisiting time).
- Date in which the crop can be reliably recognised on the field
- Time needed for the ground survey
- Time needed for ground data processing.

Foreign analysis and worldwide estimates

Waiting for official figures from the main world producers can be unacceptable for market management. Alternative sources of estimates for the largest producers become important, in particular for regions in which changes can happen quickly or major climatic events (floods, kill frost, etc.) have hit crops.

The interest of early estimates may lean on the possible doubts on the reliability of available statistical data. For example we may have some doubts on the reliability of figures provided by North Korea. In this case we want to provide independent objective data, or at least auditing existing data, i.e. deciding if they are approximately acceptable.

Area or area change?

Estimate of crop area is a foremost requirement of any crop-monitoring program. Agricultural applications where spatial information along with the crop area estimates is needed requires monitoring of area change, also. Having the information on previous year's crop area, estimates of area change is sufficient for policy makers. An issue linked with crop area change that has been insufficiently addressed is the estimation of area potentially suitable for arable crops.

Operational approaches and research topics

As stated above, this document does not intend to analyse in depth which should be the direction of research to improve the use of remote sensing for crop area estimation. We focus on clarifying what can be considered operational or pre-operational (depending on the requirements, landscape, etc) and distinguishing it from what is at a research status and still requires important breakthroughs to become operational.

We first mention tools that are at a research level, and then we give a rough classification of situations from the point of view of the user, considering first a key question: which ground data can be obtained?

1. No ground data at all.
2. A limited amount of ground data.
3. A structured ground survey can be carried out.

Some tools at a research level:

Sub-pixel approaches

The possibility to reach an operational status depends on the landscape type, in particular field size compared with the image resolution. We can say that an image has a suitable resolution for a landscape if most pixels are pure. When most pixels are mixed, for example using MODIS or MERIS images for landscapes in which fields are not very large, sub-pixel approaches (pixel unmixing or similar) can be used, but there is no documented evidence that these approaches can become operational at short term. MODIS or MERIS images can be operationally used, with a proper methodology, in landscapes with very large field size (above 100 ha per plot).

SAR images

Although major improvements have been made on the pre-processing and analysis of SAR images, the amount of noise in this type of images makes that the classification accuracy is still too far from reaching an acceptable level. There are some important exceptions to this criterion:

- the area estimation of paddy rice; in this case SAR images can be an operational tool.
- monitoring surface soil moisture in agricultural fields that may help in discriminating irrigated areas from non-irrigated areas. Optical RS data has limited potential in identifying soil moisture in the fields. SAR data from ERS-1/ERS-2, JERS-1 and Radarsat have been used in India for discriminating irrigated and non-irrigated agricultural areas

Crop area forecasting

Crop area can be estimated 4-5 months before the harvest on the basis of historical trend, economic analysis, surveys on farmers intentions or other tools. The reliability of these tools is often debatable and the contribution of remote sensing to make them more objective are been explored, but cannot be considered operational at short term.

Scenario type 1: no ground data may be obtained.

This may be the situation when no authorisation can be obtained from national authorities to visit the country (example mentioned previously of North Korea), or when a crisis situation makes the acquisition of ground data too dangerous (ex: large areas of Somalia)

In this case a combination of moderate resolution images and a sample of high resolution images is recommended; an option can be combining photo-interpretation of points on high resolution images and image classification on moderate resolution. The techniques to combine them are the same used to combine ground data with classified images: regression, calibration estimator or similar. A sampling plan (random, systematic, stratified) should be used to select high resolution images. If there are too many missing data or you can use images that have been acquired for other purposes, a modeling approach can be used, but there is a risk of bias and the accuracy assessment becomes complex and often not very reliable.

The accuracy is limited by commission-omission errors, that cannot be measured in the targeted region and need to be guessed from experience in regions that are presumed to have similar complexity of agricultural landscape.

Scenario type 2: A limited amount of ground data can be obtained.

This is the situation when national or local authorities do not put major obstacles to the collection of ground data, but do not feel involved in the project. In this case a nearly-pure remote sensing approach is obliged and the role of ground data is limited to training image classification and a coarse accuracy assessment. Table 1 summarizes the types of situation (coded with numbers 1 and 2) in which operational or pre-operational approaches are feasible.
Accuracy requirements are more likely to be reached in this type of situations combining a coverage of moderate resolution images with a sample of high resolution images.

		Nomenclature			
		Single crops		**Groups of crops**	
		Timeliness			
Landscape	Required Accuracy	**Early**	**After harvest**	**Early**	**After harvest**
Easy	**High**	*Research*	*Research*	*Research*	*Research*
Easy	**Moderate**	*(1)*	*(1)*	*(2)*	*(2)*
Complex	**High**	*Research*	*Research*	*Research*	*Research*
Complex	**Moderate**	*Research*	*Research*	*(2)*	*(2)*

Table 1: Scheme of situations for operational and research status when limited ground data can be obtained.

Comments to Table 1:
The limitation of the accuracy/objectivity is given by the order of magnitude of commission/omission errors of the higher resolution images ant the sampling error, if applicable. It should be also taken into account that commission-omission errors can be overestimated by the relative location errors of images and reference data.
Case (1) is operationally feasible when the priority is given to a dominant crop that has limited confusion with other types of vegetation. It can be also feasible under the assumption that the share of each crop in the group of crops with similar phenological calendar does not change.
In case (2) the same limitation applies for the targeted groups of crops.

The difference between approaches for groups of crops and single crops can be disregarded if it can be assumed that the share of each crop in the group is constant. In India, under FASAL program there is provision of early estimation of rabi crops (winter crops usually sown during winter and harvested before summer e.g. wheat, mustard, gram, coriander, fennel) area using multi-date IRS AWiFS data. A-priori knowledge of region specific share of different crops in rabi crops is a pre-requisite in estimation of crop area in the region. The approach is suitable to the crop regions where annual changes in contributions of constituent crops in a group of crops is insignificant. The crop regions where cropping pattern changes can be significant should not be considered for this analysis. Before applying this method the applicability of the approach needs to be ascertained using historical data. However this also means that, if cultivation shifts from one crop to another with similar phonological calendar, remote sensing will not identify this change.

Scenario type 3: Ground survey is possible.

When national authorities are actively involved in the use of remote sensing for crop area estimation, the situation substantially improves with the possibility of using a sufficiently large sample of ground data and solid methodologies combining ground and Earth Observation data.

High accuracy can be reached for important crops if the sample of ground data is sufficiently large and the efficiency of remote sensing is high.

				Nomenclature			
				Single crops		**Groups of crops**	
				Timeliness			
				Early	**After harvest**	**Early**	**After harvest**
Landscape	**Easy**	Required Accuracy	**High**	(3)	(4)	(3)	(4)
			Moderate	(3)	(4)	(3)	(4)
	Complex		**High**	(3)	(4)	(3)	(4)
			Moderate	(3)	(4)	(3)	(4)

Table 2: Scheme of situations for operational and research status when a ground survey is possible.

Cases (3) and (4): recommended approaches are regression, calibration and similar estimators (ratio, small area estimators, etc.). The main difference between both cases is that in case (3) ground survey has to be carried out quickly and early and there is a short time for data cleaning. This may result into significant errors in ground data, in particular for crops that are difficult to recognise.

Ways of using RS for area estimation

Pure remote sensing approaches

To be used when no or few ground data can be acquired. This type of approaches can be also necessary when many ground data are available, but they do not correspond to a defined sampling plan. The main warning in this case is the potential bias or subjectivity margin, which needs to be assessed.

Pixel counting

Multiplying the number of pixels classified into a class (crop, group of crops) by the area of each pixel provides a figure for the area of a crop or group of crops. The bias of area estimation by pixel counting is approximately the difference between the commission error and the omission error. Because there is no a priori reason for compensation of errors, the potential bias can be given as the order of magnitude of commission or omission errors. If the classification method can be tuned to get a reasonable number of pixels in the class, the bias becomes margin for subjectivity.

The same principle applies to similar direct estimators from fuzzy classifications or pixel unmixing methods. A generalised concept of commission and omission errors should be used.

If area estimations is obtained by polygon measurement on land cover maps obtained by photo-interpretation, additional bias can come from incompatibility of land cover nomenclature with statistical needs; in particular classes labelled as “heterogeneous”, “mosaic”, or similar, that contain an undetermined proportion of crops.

Satellite images combined with ground surveys

There are several methods, such as regression, calibration and small area estimators, that combine exhaustive but inaccurate information (from satellite images) with more accurate information on a sample (ground surveys). A wide bibliography is available for these methods.

Calibration estimators

The commission and the omission errors computed on a confusion matrix can be used to correct the bias. The main caution is that the confusion matrix has to be computed using ground information on a statistical sample of points or segments (area elements) and that the extrapolation is correctly made taking into account the sampling plan.

Confusion matrices should be computed on a sample of test points that have not been used as training points for the image classification. Both sets, training and test, should be spatially uncorrelated.

This rule can be difficult to respect in many cases, due to the limited amount of ground data. If the ground data used for image classification training are excluded from the sample used for the estimation, the result can be a worsening of the accuracy. The impact of reusing training data for the estimation is minor if robust classification algorithms are applied. In general classification algorithms are robust if they estimate a small number of parameters, including hidden or implicit parameters. Maximum likelihood with a small number of bands is fairly robust.

Regression and ratio estimator.

The regression estimator and the ratio estimator have been widely used for crop or forest area estimates with remote sensing. They respond to the same principle of calibration estimators: combining approximately unbiased information observed on the ground (or accurate photo-interpretation) for a sample, with less accurate information coming from classified images. Additional techniques of the same family include small area estimators. If the ground observations are biased, the bias will appear again in the regression or calibration estimators. This can happen if the survey is conducted by inexperienced enumerators or in an inappropriate date (before crop emergence for example)

The sampling error after regression or calibration estimators is the sampling error of the ground survey divided by the relative efficiency. Since the relative efficiency does not change much with the sampling size, bad results are obtained if the sampling size of the ground survey is too low and its sampling error is too high. The value added by remote sensing strongly depends on the accuracy of the classification and is directly proportional to the effort made in the ground survey.

Using Remote Sensing for stratification of an area sampling frame.

Most area sampling frames are stratified taking into account the priorities of the survey. Satellite images are usually the main tool for stratification, generally through Computer Assisted Photo-Interpretation (CAPI). Stratification of the territory with remote sensing is often cost-efficient because the same stratification can be used for several years. Existing land cover maps derived from earth observation are often good enough to obtain a satisfactory efficiency.

Crop masks.

For area estimation crop/non-crop masks can be seen as a particular case of stratification. The mask, i.e. the area where the crop(s) is supposed to be absent is a specific stratum that can be ignored for the sampling and the estimation process. Some care is needed before excluding one stratum (masking) from the sampling/estimation process in regions with a complex landscape. In western Europe several experiences indicate that around 4% of the arable land was located in strata that had been labelled as “non agricultural”. Using masks makes classification simpler and faster. Masks can be used for more than 5 years, unless fast changes are ongoing.

Substituting ground data with Earth Observation.

Regression or calibration estimators usually combine ground observations on a sample with a blanket cover of satellite images. The same principle can be used to combine a sample of high resolution images (pixel size < 10 m) with a blanket coverage of lower resolution images. This approach can be recommended in particular when no ground survey is possible for security or authorisation reasons (e.g.: North Korea, Somalia). The potential bias or subjectivity is mainly determined by the order of magnitude of the commission and the omission errors of the higher resolution images.

Other ways of using Earth Observation.

There is a wide range of other approaches for specific situations. We can mention for example the use of high resolution to delineate fields and coarse resolution for the classification, as applied in a test study in Kazakhstan, that can be interesting for areas with very large fields.

Accuracy assessment:

Accuracy should be analysed in any statistical estimation, and this is particularly true with operations involving remote sensing and area frame surveys. The accuracy of image classification or mapping should not be confused with the accuracy of the estimators of crop area, although both are linked. The type of link depends on the area estimation approach. There are two main types of inaccuracy: sampling errors and non-sampling errors.

Sampling errors

Sampling error is generally expressed through standard errors or coefficient of variation of the area estimates. The classical sampling theory provides a wide range of formulas for this purpose, including for regression, calibration or small area estimators. Estimation of sampling errors is not always straightforward, and some statistical problems remain open, such as better using the spatial structure of the sample for the estimation of standard errors, but altogether tools are available for this assessment.

Non-sampling errors

Non-sampling errors can be more important and more difficult to compute than sampling errors. Unlike the sampling errors, in general they do not decrease when the sample size increases, and they introduce a systematic bias in the results. Non-sampling errors of ground surveys should be assessed by comparing the ground observations with a ground check survey on a subsample carried out by selected surveyors. They are generally low (<1-2%) for major crops when expert surveyors conduct the survey, but can reach 5-10% and even more for minor crops when the surveyors have little experience. For area estimation by pixel-counting or similar approaches, non-sampling errors can be of the order of magnitude of commission or omission errors. Approaches combining ground surveys with classified images, such as regression or calibration estimators, have the bias of the ground surveys. Bias in the classified images is not transmitted to the estimators. Some sources of bias are often disregarded; for example the area of linear elements (roads, etc.), that may be attributed to fields. This type of bias can reach 2% in some regions, but it can be estimated and corrected. The approximate coincidence of estimates with official statistics, or other crop area estimates, cannot be taken as an indication of the validity of the results. This is particularly true with "pixel counting" or similar approaches, because of the significant room for subjectivity, that should be quantified through the commission/omission errors.

Objectivity and subjectivity of the estimates.

All statistical operations have a certain degree of subjectivity; the margin for subjectivity is not easy to quantify in a precise way, but indications should be given on its order of magnitude. Subjectivity is often introduced when trying to correct non-sampling errors; thus it can be as important as the potential bias.

In the case of area frame surveys, the main source of subjectivity is the detection and correction of errors or outliers, such as codes of crops that do not exist in a given region. Final results can have a certain fluctuation as a consequence of data cleaning performed by the analyst. Such fluctuation may be of the order of 1-2% for major crops, but can be higher for minor crops, in particular if the experience of ground surveyors is insufficient.

In satellite image analysis, in particular if pixel counting or similar approaches are used, the flexibility of the estimator depends mainly on two elemets: the way of using remote sensing and the accuracy of image classification. If the classification algorithm is a "black box", i.e. if there is no possibility to tune parameters, the bias is roughly the difference between the commission error and the omission error and can be of the same order of magnitude, because there is no reason for systematic compensation.

In most image classification approaches the analyst can adapt some parameter of the algorithm to the specific circumstances, such as landscape or atmospheric situation; adapting parameters allows to improve the compensation between commission and omission errors, reducing the bias; in this case the risk of bias becomes margin for subjectivity, always with the order of magnitude of the commission or omission errors.

Analysis of cost (Remote sensing, ground surveys, list frames).

The efficiency of remote sensing depends on many factors, including the cost of ground observations, the complexity of the landscape type and of the image analysis (images with a wide swath can be more cost-efficient).

Under normal conditions, techniques combining ground data with remote sensing data are recommended: regression and calibration estimators or similar procedures. The economic assessment of remote sensing can be made through the relative efficiency, computed as the ratio between the variance obtained from the ground survey and the variance after adding the information of classified images. An efficiency of 2 means that the accuracy obtained from a ground survey with a sample of *n* segments and remote sensing is the same as the accuracy with a sample of *2n* segments without remote sensing. In this case, the cost of remote sensing should be compared with the cost of *n* segments in the ground survey.

The crop mapping provided by image classification has an additional value that is more difficult to quantify, because it depends on the use that the customers (decision makers) manage to make of the maps.

Additional issues

Non-administrative geographical units

Traditional needs mainly focus on area estimates for large administrative units (region, country). Other specific needs have emerged for information in spatial units that do not coincide with administrative regions, for example:

- Area hit by a natural disaster: drought, kill-frost, windstorm, flood, etc. Mapping where events have hit is a major product by itself and complements traditional statistics.
- Cells of a grid. Crop presence information in cells of a grid is an important input for yield modelling or environmental assessment.

For example the success of an analysis to assess floods depends on the availability of pre-event and post-event cloud free RS data, identification of crops before the event etc. For the crop area that could not be detected before the event, the impact will be more difficult to assess.

For traditional farm surveys this type of target may be a major problem, but for approaches based on area frame sampling and remote sensing, the methodology is relatively easy to adapt. If quick results are required, few or no current ground data can be obtained and the criteria stated above should be applied accordingly.

Estimation of cultivated/harvested area.

Cultivated and harvested area can be substantially different in some regions of the world, in particular in arid countries. For the estimation of production, harvested area is usually the most important information if yields are estimated with regard to harvested area. Making the difference between both concepts is a delicate problem both for ground surveys and for remote sensing approaches. The issue needs to be analysed on a case-by-case basis keeping in mind that production is generally the main target.

Annex

Attendants to the workshop that elaborated this document.

BARTALEV	Sergey	Space Research Institute, Russian Academy of Sciences
BARUTH	Bettina	European Commission- JRC
BECKER-RESHEF	Inbal	University of Maryland - US
BODART	Catherine	European Commission- JRC
BOSSYNS	Bert	VITO - Belgium
BRINK	Andreas	European Commission- JRC
CARDOSO	Fausto	European Commission- EUROSTAT
CARFAGNA	Elisabetta	University of Bologna
CASTELLI	Cecilia	SAGPyA - Argentina
CRAIG	Michael	MEC GeoStat Inc - US
DEFOURNY	Pierre	UCL-Geomatics - Belgium
DELINCÉ	Jacques	European Commission- JRC
DELRUE	Josefien	VITO - Belgium
DONG	Qinghan	VITO - Belgium
DUPONCEL	Marc	European Commission – DG AGRI
FAN	Jinlong	China Meteorological Administration
FRITZ	Steffen	IIASA International Institute for Applied Systems Analysis
GALLEGO	Javier	European Commission- JRC
GIOVACCHINI	Aldo	Consorzio ITA - Italy
HANSEN	Matthew	South Dakota State University - US
HAUB	Carsten	EFTAS Fernerkundung - Germany
HOLECZ	Francesco	SARMAP - Switzerland
HUSAK	Greg	University of California, Santa Barbara - US
JUSTICE	Christopher	University of Maryland Geography Department - US
KEITA	Naman	FAO Statistics Division- National Statistical Systems Group
LEO	Olivier	European Commission- JRC
LINDSEY	Mary	University of Maryland - US
MASSART	Michel	European Commission- JRC
MICHAELSEN	Joel	UC Santa Barbara - US
NARCISO	Giovanni	European Commission- JRC
NEWBY	Terry	ARC-ISCW. South Africa
PARIHAR	Jai singh	Indian Space Research Organisation
RAST	Michael	GEO Secretariat
REYNOLDS	Curt	USDA – Foreign Agricultural Service
ROCHA	Jansle	University of Campinas - Brazil
ROYER	Antoine	European Commission- JRC
SINGH	Karan deo	Ashoka Trust for Environment and Ecology - India
TEREKHOV	Alexey	Centre of Astrophysical Research – Kazakhstan
VERDIN	James	NOAA/USGS/NIDIS Program Office - US
WILLEMS	Eric	European Commission – DG AGRI

European Commission

EUR 24104 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen
Title: *GEOSS Community of Practice Ag 0703a. Best practices for crop area estimation with Remote Sensing*
Authors: Gallego J., Craig M., Michaelsen J., Bossyns B., Fritz S.
Luxembourg: Publications Office of the European Union
2010 – 10 pp. – 21 x 29,7 cm
EUR – Scientific and Technical Research series – ISSN 1018-5593
doi 10.2788/31835

Abstract

GEOSS (Global Earth Observation System of Systems) is an initiative to network earth observation professionals and researchers. GEOSS promotes technical standards for different aspects of remote sensing. This document is one of them; it is dedicated to the use of remote sensing for crop area estimation. The purpose is giving a simplified summary of the methods and of kinds of satellite data that can be used in operational projects and those that still require research. Satellite data: Synthetic Aperture Radar (SAR) images cannot be considered operational for crop area estimation, except for paddy rice. Coarse or moderate resolution optical images are operational only for landscapes with very large fields. In general terms, pure remote sensing approaches are acceptable in two cases: when a ground survey is not possible (because local authorities are not involved or due to security problems) or when the accuracy requirements are looser than the commission/omission errors. Crop area forecasting several months before harvest is not operational in general, but interesting indications can be given if the uncertainty on cultivated area is high.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

LB-NA-24104-EN-C

JRC
EUROPEAN COMMISSION

Publications Office

ISBN 978-92-79-16211-4